

LISTING OF THE CLAIMS

Following is a listing of all claims in the present application, which is presented for the Examiner's convenience:

1. (Currently Amended) A stack-type capacitor, comprising:

a lower electrode on a diffusion barrier layer;

a dielectric layer formed on the lower electrode; and

an upper electrode formed on the dielectric layer,

wherein the lower electrode includes:

a first metal layer having a cylindrical shape and defining a cylindrical

space; and

a second metal layer completely filling the cylindrical space defined by the

first metal layer,

the second metal layer has a greater reactivity towards oxygen than the diffusion barrier layer,

the diffusion barrier layer is a nitride layer, [[and]]

the first metal layer is a ruthenium layer, and

the second metal layer is a nitride and aluminum layer.

2. (Cancelled).

3. (Previously Presented) The capacitor as claimed in claim 1, wherein the nitride and aluminum layer is a titanium aluminum nitride layer or a tantalum aluminum nitride layer.

4. (Cancelled).

5. (Currently Amended) A semiconductor memory device including a stack-type capacitor, the device comprising a transistor and a capacitor,

wherein the capacitor includes:

a lower electrode on a diffusion barrier layer;

a dielectric layer formed on the lower electrode; and

an upper electrode formed on the dielectric layer,

wherein the lower electrode includes:

a first metal layer having a cylindrical shape and defining a cylindrical space; and

a second metal layer completely filling the cylindrical space defined by the first metal layer,

the second metal layer has a greater reactivity towards oxygen than the diffusion barrier layer,

the diffusion barrier layer is a nitride layer, [[and]]

the first metal layer is a ruthenium layer, and

the second metal layer is a nitride and aluminum layer.

6. (Previously Presented). The device as claimed in claim 7, wherein the transistor is electrically connected to the capacitor by the conductive plug disposed under the diffusion barrier layer.

7. (Previously Presented) The device as claimed in claim 5, wherein the diffusion barrier layer is formed between the lower electrode and a conductive plug.

8 - 9. (Cancelled).

10. (Previously Presented) The device as claimed in claim 5, wherein the nitride and aluminum layer is a titanium aluminum nitride layer or a tantalum aluminum nitride layer.

11. (Currently Amended) The device as claimed in claim 5 [[9]], wherein the upper electrode is a ruthenium layer.

12 - 24. (Cancelled).

25. (Previously Presented) The capacitor as claimed in claim 1, wherein the second metal layer includes aluminum.

26. (Previously Presented) The capacitor as claimed in claim 25, wherein the diffusion barrier layer is substantially free of aluminum.

27. (Previously Presented) The capacitor as claimed in claim 1, wherein:
the diffusion barrier layer consists of a first set of compounds, and
the second metal layer includes the first set of compounds and a material that is reactive towards oxygen.

28. (Previously Presented) The capacitor as claimed in claim 27, wherein the material that is reactive towards oxygen includes aluminum.

29. (Previously Presented) The capacitor as claimed in claim 3, wherein the diffusion barrier layer includes titanium and nitride, tungsten and nitride, and/or tantalum and nitride.

30. (Previously Presented) The capacitor as claimed in claim 1, wherein the first metal layer is disposed proximate to and substantially equidistant to both the diffusion barrier layer and the second metal layer.

31. (Previously Presented) The device as claimed in claim 5, wherein the second metal layer includes aluminum.

32. (Previously Presented) The device as claimed in claim 31, wherein the diffusion barrier layer is substantially free of aluminum.

33. (Previously Presented) The device as claimed in claim 5, wherein:
the diffusion barrier layer consists of a first set of compounds, and
the second metal layer includes the first set of compounds and a material that is reactive towards oxygen.

34. (Previously Presented) The device as claimed in claim 33, wherein the material that is reactive towards oxygen includes aluminum.

35. (Previously Presented) The device as claimed in claim 5, wherein the diffusion barrier layer includes titanium and nitride, tungsten and nitride, and/or tantalum and nitride.

36. (Previously Presented) The device as claimed in claim 5, wherein the first metal layer is disposed proximate to and substantially equidistant to both the diffusion barrier layer and the second metal layer.

37. (New) The capacitor as claimed in claim 1, wherein a cylindrical sidewall of the cylindrical shape is ruthenium, such that the nitride and aluminum layer within the ruthenium cylindrical sidewall is in contact with the ruthenium cylindrical sidewall.

38. (New) The capacitor as claimed in claim 1, wherein a vertical cross-section through a center of the capacitor includes, in sequence, the upper electrode, the dielectric layer, the nitride and aluminum layer, the ruthenium layer, and the nitride layer.

39. (New) The device as claimed in claim 5, wherein a cylindrical sidewall of the cylindrical shape is ruthenium, such that the nitride and aluminum layer within the ruthenium cylindrical sidewall is in contact with the ruthenium cylindrical sidewall.

40. (New) The device as claimed in claim 5, wherein a vertical cross-section through a center of the capacitor includes, in sequence, the upper electrode, the dielectric layer, the nitride and aluminum layer, the ruthenium layer, and the nitride layer.